

WEST Search History

DATE: Friday, March 21, 2003

Set Name **Query**
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DB=USPT,PGPB,JPAB,EPAB,DWPI; PLUR=YES; OP=OR

L12	l5 and l8 and L11	22	L12
L11	L10.clm.	192691	L11
L10	encapsulate or coat or coated or coating or encapsulating	1702880	L10
L9	l6 and l7 and L8	18	L9
L8	l3.clm.	7812	L8
L7	l2.clm.	185310	L7
L6	l4 and L5	314	L6
L5	l1.clm.	1816	L5
L4	l1 and l2 and L3	1870	L4
L3	flavor or flavour or flavorant or flavourant or flavouring or flavoring	117421	L3
L2	encapsulate or coat or coated or coating	1685238	L2
L1	cyclodextrin	15644	L1

END OF SEARCH HISTORY

NEWS 44 Feb 24 METADEX enhancements
 NEWS 45 Feb 24 PCTGEN now available on STN
 NEWS 46 Feb 24 TEMA now available on STN
 NEWS 47 Feb 26 NTIS now allows simultaneous left and right truncation
 NEWS 48 Feb 26 PCTFULL now contains images
 NEWS 49 Mar 04 SDI PACKAGE for monthly delivery of multifile SDI results
 NEWS 50 Mar 19 APOLLIT offering free connect time in April 2003
 NEWS 51 Mar 20 EVENTLINE will be removed from STN

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 CURRENT MACINTOSH VERSION IS V6.0b(ENG) AND V6.0Jb(JP),
 AND CURRENT DISCOVER FILE IS DATED 01 OCTOBER 2002
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=> file fsta frosti		
COST IN U.S. DOLLARS	SINCE FILE	TOTAL
	ENTRY	SESSION
FULL ESTIMATED COST	0.21	0.21

FILE 'FSTA' ENTERED AT 12:06:56 ON 21 MAR 2003
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=> s cyclodextrin#
 L1 1885 CYCLODEXTRIN#

=> s flavor# or flavour# or flavoring# or flavouring# or flavourant# or flavorant#
 L2 96114 FLAVOR# OR FLAVOUR# OR FLAVORING# OR FLAVOURING# OR FLAVOURANT#
 OR FLAVORANT#

=> s coat? or encapsulat?
 L3 26094 COAT? OR ENCAPSULAT?

=> s l1 and l2 and l3
 L4 134 L1 AND L2 AND L3

=> s l2.ti.
 L5 0 L2.TI.

=> s l2/ti

L6 19813 L2/TI

=> s 14 and 16

L7 51 L4 AND L6

=> d 1-51 all

L7 ANSWER 1 OF 51 FSTA COPYRIGHT 2003 IFIS

AN 2003:T0208 FSTA

TI **Flavor encapsulation** technologies: an overview including recent developments.

AU Uhlemann, J.; Schleifenbaum, B.; Bertram, H. J.

CS Haarmann & Reimer GmbH, PO Box 1253, 37603 Holzminden, Germany

SO Perfumer & Flavorist, (2002), 27 (5) 52, 54-61, 28 ref.

ISSN: 0272-2666

DT General Review

LA English

AB An overview is presented of economically feasible and commercially available **flavour encapsulation** technologies. Individual aspects considered include: modern **encapsulation** technologies that satisfy numerous requirements (e.g. designable properties, easy product handling, improved shelf life, controlled release); spray drying; compacting and agglomeration; fluidized spray drying; fluidized bed methods (spray granulation and **coating**); extrusion; coacervation and submerged nozzle process; spray chilling; and molecular inclusion (.beta.-**cyclodextrin**).

CC T (Additives, Spices and Condiments)

CT **ENCAPSULATION; FLAVOURINGS; REVIEWS; DEVELOPMENTS**

L7 ANSWER 2 OF 51 FSTA COPYRIGHT 2003 IFIS

AN 2002:T0171 FSTA

TI **Flavor encapsulation** and release characteristics of spray-dried powder by the blended encapsulant of **cyclodextrin** and gum arabic.

AU Shiga, H.; Yoshii, H.; Nishiyama, T.; Furuta, T.; Forssele, P.; Poutanen, K.; Linko, P.

CS Dep. of Biotech., Tottori Univ., Tottori 680-8552, Japan

SO Drying Technology, (2001), 19 (7) 1385-1395, 11 ref.

ISSN: 0737-3937

DT Journal

LA English

AB Powdered **flavourings** with high **flavour** content and controlled release nature were prepared by spray drying, using a blend of .beta.-**cyclodextrin** (.beta.-CD) and gum arabic as encapsulants and maltodextrin as wall material. d-Limonene and ethyl n-hexanoate were used as model **flavour** compounds. Application of high pressure (using a microfluidizer) to the mixture of **flavour** compounds and .beta.-CD slurry was an effective means of forming inclusion complexes. **Flavour** retention during spray drying using various compositions of the encapsulants was investigated. **Flavour** retention using blended encapsulants increased when gum arabic was included. Characteristics of release of the **encapsulated flavour** compounds during storage were evaluated at 50.degree.C and 75% RH. The **flavour** release rate for the spray dried powders depended on **flavour** compound type, and composition of the encapsulant. Blending of maltodextrin and .beta.-CD in the feed liquid decreased the **flavour** release rate. Rate of release of **flavour** was analysed using Avrami's equation.

CC T (Additives, Spices and Condiments)

CT AROMA COMPOUNDS; DEXTRINS; **FLAVOUR; FLAVOUR COMPOUNDS; GUMS; PRESSURE; SPRAY DRYING; STORAGE; TERPENOID; CYCLODEXTRINS**; ETHYL N-HEXANOATE; GUM ARABIC; LIMONENE; MALTODEXTRINS

L7 ANSWER 3 OF 51 FSTA COPYRIGHT 2003 IFIS
 AN 2002:T0145 FSTA
 TI Microencapsulation techniques of food **flavors**.
 AU Druri, M.; Pawlik, A.
 CS Inst. Podstaw Chem. Zywnosci, Politech. Lodzka, Lodz, Poland
 SO Przemysl Spozywczy, (2001), 55 (3) 26, 31-33, 21 ref.
 ISSN: 0033-250X
 DT Journal
 LA Polish
 SL English
 AB This article discusses techniques currently in use for **encapsulation of flavourings and flavour** compounds used by the food industry. Aspects considered include: methods for spray-drying, agglomeration, extrusion, coacervation, incorporation of **cyclodextrins** and spray-solidification; properties of various materials (maltodextrins, starch syrups, gum arabic) used for capsule formation; and potential application of **encapsulated flavourings** in the design of new foods.
 CC T (Additives, Spices and Condiments)
 CT **ENCAPSULATION; FLAVOURINGS**

L7 ANSWER 4 OF 51 FSTA COPYRIGHT 2003 IFIS
 AN 2001(10):P1620 FSTA
 TI The influence of .beta.-**cyclodextrin** on goaty **flavour**. Characterization of synthetic inclusion complexes with capric acid and caprylic acid.
 AU Meier, M. M.; Drunkler, D. A.; Bordignon Luiz, M. T.; Fett, R.; Szpoganicz, B.
 CS Federal Univ. of Santa Catarina, Florianopolis, Brazil
 SO British Food Journal, (2001), 103 (4) 281-290, 23 ref.
 ISSN: 0007-070X
 DT Journal
 LA English
 AB Ability of .beta.-**cyclodextrin** (.beta.CD) to improve the **flavour** of goats' milk was determined by sensory analysis, and interactions between .beta.CD and capric (C10) and caprylic (C8) acid were investigated by .sup.1H-NMR and DSC. Optimal .beta.CD concn. for reduction of the goaty taste in goat milk were found to be 0.35 and 0.4% (w/v). No significant differences in physicochemical properties were observed between untreated goats' milk and that treated with .beta.CD. DSC curves confirmed the formation of complexes between .beta.CD and capric and caprylic acid, due to the absence of energy absorption at the normal m.p. of the 2 fatty acids when .beta.CD was present. Comparison of .sup.1H-NMR spectra of pure .beta.CD and .beta.CD/C10 complex suggested that the latter was an inclusion complex formed primarily by interactions occurring between the hydrophobic regions of the .beta.CD cavity and the C10 hydrocarbon chain. It is concluded that .beta.CD improves the **flavour** of goats' milk by **encapsulating** short-chain fatty acids such as capric and caprylic acids.
 CC P (Milk and Dairy Products)
 CT DEXTRINS; **ENCAPSULATION; FATTY ACIDS; FLAVOUR; FLAVOUR COMPOUNDS; GOATS; MILK; CAPRIC ACID; CAPRYLIC ACID; CYCLODEXTRINS; GOAT MILK**

L7 ANSWER 5 OF 51 FSTA COPYRIGHT 2003 IFIS
 AN 2001(09):E0456 FSTA
 TI **Flavour** retention during high temperature short time extrusion cooking process: a review.
 AU Bhandari, B.; D'Arcy, B.; Young, G.
 CS Food Sci. & Tech., Sch. of Land & Food Sci., Univ. of Queensland, Gatton, Qld. 4345, Australia. Fax +61 754601171. E-mail bb(a)fst.uq.edu.au

SO International Journal of Food Science & Technology, (2001), 36 (5)
453-461, 36 ref.
ISSN: 0950-5423

DT General Review

LA English

AB Research on stability of **flavours** during HTST extrusion cooking of foods is reviewed. The important factors that affect **flavour** and aroma retention during extrusion are illustrated. A substantial number of **flavour** volatiles which are incorporated prior to extrusion are normally lost during expansion; this is because of steam distillation. Therefore, a general practice has been to introduce a **flavour** mix after the extrusion process. This extra operation requires a binding agent (normally oil), and may also result in a non-uniform distribution of **flavour** and low oxidative stability of the **flavour** compounds exposed on the surface. Therefore, the importance of **encapsulated flavours**, particularly the .beta.-**cyclodextrin-flavour** complex, is highlighted.

CC E (Engineering)

CT AROMA; DEXTRINS; **ENCAPSULATION**; EXTRUSION; **FLAVOUR**; **FLAVOUR COMPOUNDS**; PASTEURIZATION; REVIEWS; STABILITY; **CYCLODEXTRINS**; EXTRUSION COOKING; HTST PASTEURIZATION

L7 ANSWER 6 OF 51 FSTA COPYRIGHT 2003 IFIS

AN 2000(05):T0405 FSTA

TI Starch-based ingredients for **flavour encapsulation**.

AU Qi, Z. H.; Xu, A.

CS Cerestar USA Inc., Hammond, IN, USA

SO Cereal Foods World, (1999), 44 (7) 460-465, 38 ref.
ISSN: 0146-6283

DT Journal

LA English

AB Properties and uses of 3 starch-based **encapsulating** agents, namely starch hydrolysis products (SHP, starch hydrolysates), emulsifying starches (starches modified with n-octenylsuccinic anhydride (n-OSA)) and .beta.-**cyclodextrin**, are discussed with reference to their use as **encapsulating** agents for food additives, including **flavourings**, sweeteners and essential oils. Aspects considered include: methods for **flavour encapsulation** (spray drying and extrusion); effect of degree of hydrolysis on properties of SHP; effect of depolymerization method on properties of n-OSA-modified starches (acid hydrolysis, enzyme hydrolysis, pyrodextrinization), applications of n-OSA-modified starches; inclusion complexation by .beta.-**cyclodextrin**; and functions of .beta.-**cyclodextrin** in various applications (e.g. solubilization of chalcone and dihydrochalcone sweeteners, and long-term stability of .beta.-**cyclodextrin**-garlic oil complexes).

CC T (Additives, Spices and Condiments)

CT ADDITIVES; DEXTRINS; **ENCAPSULATION**; STARCH; SUGAR SYRUPS; **CYCLODEXTRINS**; MODIFIED STARCHES; STARCH HYDROLYSATES

L7 ANSWER 7 OF 51 FSTA COPYRIGHT 2003 IFIS

AN 2000(02):T0100 FSTA

TI **Flavour encapsulation** applications.

AU Vandana Sharma; Sumit Arora; Sindhu, J. S.

CS Dairy Chem Div., Nat. Dairy Res. Inst., Karnal 132 001, India

SO Indian Food Industry, (1999), 18 (1) 39-48, 26 ref.

DT Journal

LA English

AB Microencapsulation of **flavour** compounds is discussed. Aspects considered include: reasons for **encapsulation**; terms related to **encapsulation** (wall/capsule, dehydration media, core material, process liquid/suspending liquid); various techniques of

microencapsulation (spray drying (gum acacia, modified starches, maltodextrins, hydrolysed starch), coacervation, molecular inclusion using **cyclodextrins**, Balchem process, organic phase separation process, extrusion, physical process, fat **encapsulation**); applications of fat **encapsulation** (**flavour** survival strategy, vitamins **encapsulation**); chewing gum applications; yoghurts; bakery products and confectionery; tofu; microencapsulation of orange oil; coffee aroma **encapsulation**; spices and oil **encapsulation**; a novel milk product (dried cream extract) with **encapsulated flavour**; process for manufacture of dried cheese **flavouring**; and cheese **flavour** development.

CC T (Additives, Spices and Condiments)

CT **ENCAPSULATION; FLAVOUR COMPOUNDS; FOODS; MICROENCAPSULATION**

L7 ANSWER 8 OF 51 FSTA COPYRIGHT 2003 IFIS

AN 1997(06):T0013 FSTA

TI **Flavor** technology: physical chemistry, modification, and process.

AU Chi-Tang Ho (Editor); Chee-Teck Tan (Editor); Chao-Hsiang Tong (Editor)

CS 1155 Sixteenth St., NW, Washington, DC 20036, USA; American Chemical Society. Price \$69.95 Dep. of Food Sci., Cook Coll., Rutgers Univ., PO Box 231, New Brunswick, NJ 08903, USA

SO ACS Symposium Series, (1995), No. 610, xi + 266pp. ISBN 9-8412-3326-8, many ref.

ISSN: 0097-6156

DT Book

LA English

AB This publication outlines aspects of aroma research and **flavour** technology. The book is divided into 19 chapters in the following sections: Kinetics of **flavor** reactions (pp. 20-62, many ref.); Modeling (pp. 63-118, many ref.); Effects of processing and storage on **flavors** (pp. 119-151, many ref.); and Emulsion and stabilization of **flavors** (pp. 153-253, many ref.). Individual topics considered include: physical chemistry in **flavour** products preparation; kinetics of formation and degradation of morpholino-1-deoxy-D-fructose; kinetics of formation of oxygen-containing heterocyclic compounds via the Maillard reaction; effect of water content and amino acids on Maillard browning kinetics in propylene glycol based model systems during microwave heating; kinetics of tetramethylpyrazine formation under high hydrostatic pressure; modelling Maillard browning in dehydrated food systems as a function of temp., moisture content and glass transition temp.; computer simulation of the Maillard reaction; implementation of process kinetics to scale up automated thermally reacted **flavour** processes; production of natural **flavours** using a cold extrusion process; a novel membrane process for folding essential oils; oxidative stability of **encapsulated** seal blubber oil; location of vanillin in a food emulsion system; methods to predict physical stability of **flavour**-cloud emulsion; surface dilational rheological properties of protein-adsorbed interfaces; role of speciality food starches in **flavour** emulsions and **encapsulation**; properties and potential uses of phospholipid liposomes and nonphospholipid liposomes in **flavour encapsulation**; and use of **cyclodextrins** for **flavourings**. An 11-pp. subject index is included.

CC T (Additives, Spices and Condiments)

CT **ADDITIVES; BOOKS; FLAVOUR; FLAVOURINGS; SENSORY PROPERTIES**

L7 ANSWER 9 OF 51 FSTA COPYRIGHT 2003 IFIS

AN 1997(01):T0020 FSTA

TI Microencapsulated **flavours**: manufacture and possible

applications.

AU Eckert, M.

SO ZFL, Internationale Zeitschrift fuer Lebensmittel-Technik, Marketing, Verpackung und Analytik, (1996), 47 (5) 67-70; (6) 63-65, 6 ref.
ISSN: 0722-5733

DT Journal

LA English

AB Microencapsulation of **flavourings** for use in foods is discussed with reference to: advantages of microencapsulation; spray drying; vacuum drying; extrusion; coacervation; molecular **encapsulation** in .alpha.-**cyclodextrin**; **coating** processes; and economic aspects.

CC T (Additives, Spices and Condiments)

CT ADDITIVES; **ENCAPSULATION**; **FLAVOURINGS**; **FOOD FLAVOURINGS**; MICROENCAPSULATION

L7 ANSWER 10 OF 51 FSTA COPYRIGHT 2003 IFIS

AN 1995(01):T0001 FSTA

TI Development of CD inclusion **flavor** essences, horseradish essences, menthol and ethanol for food additives.

AU Ikushima, K.; Yashiki, I.; Kuwabara, N.; Hara, K.; Hashimoto, H.; Okura, I.

CS Dep. of Bioeng., Tokyo Inst. of Tech., 4259, Nagatsuta-cho Midori-ku, Yokohama 227, Japan

SO Journal of Applied Glycoscience, (1994), 41 (2) 197-200, 13 ref.
ISSN: 1340-3494

DT Journal

LA Japanese

SL English

AB **Cyclodextrin** inclusion complexes **encapsulating flavour** essences from citrus fruits (orange, lemon, citron, iyo, and sudachi), menthol, horseradish essence, and ethanol were prepared. It is suggested that these complexes could be effectively used as food additives because of their high thermostability. [From En summ.]

CC T (Additives, Spices and Condiments)

CT ADDITIVES; **ENCAPSULATION**; **FLAVOURINGS**; **FOOD FLAVOURINGS**

L7 ANSWER 11 OF 51 FSTA COPYRIGHT 2003 IFIS

AN 1993(03):K0034 FSTA

TI **Flavor** and taste composition for a chewing gum.

IN Sato, Y.; Suzuki, Y.; Ito, K.; Shinagawa, T.

PA Lotte Co. Ltd.; Lotte, Tokyo, Japan

SO United States Patent, (1992)

PI US 5156866

PRAI JP 1990-141600 19900601

DT Patent

LA English

AB A controlled release **flavour** composition for use in chewing gums is described, which comprises particles of **flavour** component (comprising at least 1 **flavouring** agent such as a sugar or nonsugar sweetener, spice, peptide/amino acid or various salts or organic acids) **coated** with a sterol (of m.p. .gtoreq.100.degree.C) at a wt. ratio of sterol:**flavouring** agent of 99:1-50:50. A softening agent may also be included at about 50% by wt. The particles of **flavour** component may be produced by adsorption of a **flavouring** agent in the form of an oil onto a .beta.-**cyclodextrin** carrier.

CC K (Cocoa and Chocolate and Sugar Confectionery Products)

CT ADDITIVES; CHEWING GUMS; **FLAVOURINGS**; PATENTS; SUGAR CONFECTIONERY

L7 ANSWER 12 OF 51 FSTA COPYRIGHT 2003 IFIS
 AN 1993(02):A0001 FSTA
 TI Stereoisomeric **flavor** compounds. LVIII. The use of
 heptakis(2,3-di-O-methyl-6-O-tert-butyltrimethylsilyl)-.beta.-cyclodextrin
 as a chiral stationary phase in **flavor** analysis.
 AU Dietrich, A.; Maas, B.; Messer, W.; Bruche, G.; Karl, V.; Kaunzinger, A.;
 Mosandl, A.
 CS Correspondence (Reprint) address, A. Mosandl, Inst. fuer
 Lebensmittelchem., Univ. Frankfurt, W-6000 Frankfurt/Main, Germany
 SO Journal of High Resolution Chromatography and Chromatography
 Communications, (1992), 15 (9) 590-593, 21 ref.
 ISSN: 0344-7138
 DT Journal
 LA English
 AB Modified **cyclodextrins** are used widely as chiral stationary
 phases in GC, but solubility of one of the most versatile modified forms,
 permethyl-.beta.-**cyclodextrin** (PME-.beta.-CD) in non-polar
 polysiloxane gums (which are easier to coat and give higher
 plate numbers than polar phases) is limited. Synthesis and properties of
 the new chiral stationary phase heptakis (2,3-di-O-methyl-6-O-tert-
 butyltrimethylsilyl)-.beta.-cyclodextrin (DIME-6-TBDMS-.beta.-CD), that is
 highly soluble in polysiloxanes, are described. Enantiomers of many
 substances of different chemical classes (e.g. filbertone, .beta.-pinene,
 borneol, methyl jasmonate, 3-mercaptopentanol) were better resolved on
 DIME-6-TBDMS-.beta.-CD than on PME-.beta.-CD under identical
 chromatographic conditions. Only a few substances (e.g. 2-ethylhexanoic
 acid, 2,2,2-trifluorophenylethanol) could be resolved on PME-.beta.-CD but
 not on DIME-6-TBDMS-.beta.-CD. In general, increasing the amount of
 DIME-6-TBDMS-.beta.-CD increased chiral selectivity, but this was not
 always the case.
 CC A (Food Sciences)
 CT ANALYTICAL TECHNIQUES; DEXTRINS; **FLAVOUR COMPOUNDS**; GAS
 CHROMATOGRAPHY; ISOMERS; POLYSACCHARIDES; SEPARATION;
CYCLODEXTRINS; ENANTIOMERS; GC

L7 ANSWER 13 OF 51 FSTA COPYRIGHT 2003 IFIS
 AN 1991(09):A0038 FSTA
 TI Stereoisomeric **flavor** compounds. 48. Chirospecific analysis of
 natural **flavors** and essential oils using multidimensional gas
 chromatography.
 AU Mosandl, A.; Fischer, K.; Hener, U.; Kreis, P.; Rettinger, K.; Schubert,
 V.; Schmarr, H. G.
 CS Inst. fuer Lebensmittelchem., Univ. Frankfurt, D-6000 Frankfurt/Main,
 Federal Republic of Germany
 SO Journal of Agricultural and Food Chemistry, (1991), 39 (6) 1131-1134, 28
 ref.
 ISSN: 0021-8561
 DT Journal
 LA English
 AB Multidimensional GC (MDGC), employing heart-cutting techniques from a
 polar and nonchiral preseparation column onto a chiral main column,
 coated with heptakis(2,3,6-tri-O-methyl)-.beta.-
cyclodextrin as the chiral stationary phase, is proved to be a
 rather sensitive method of high selectivity to differentiate the
 enantiomers of 2-methylbutanoic acid (esters), chiral monoterpenes,
 alkan-2-ols, alken-2-ols, and 1,2-ketols from complex matrices. The
 specific distribution of enantiomers is discussed as an indicator for the
 genuineness of natural **flavours** and essential oils [enantiomeric
 composition of chiral compounds in apple, banana and honey extracts, and
 mint oils is reported].
 CC A (Food Sciences)
 CT ANALYTICAL TECHNIQUES; ESSENTIAL OILS; **FLAVOUR COMPOUNDS**;

**FLAVOURIN S; ISOMERS; OILS; SEPARATION; VOLATILE COMPOUNDS;
ANALYSIS; ENANTIOMERS; FOODS; GAS LIQUID CHROMATOGRAPHY**

- L7 ANSWER 14 OF 51 FSTA COPYRIGHT 2003 IFIS
AN 1991(01):A0017 FSTA
TI Stereoisomeric **flavor** compounds. XLI. New applications of permethylated .beta.-**cyclodextrin** phase in chiral CGC analysis.
AU Mosandl, A.; Rettinger, K.; Fischer, K.; Schubert, V.; Schmarr, H. G.; Maas, B.
CS Inst. fuer Lebensmittelchm., Univ. Frankfurt, D-6000 Frankfurt/Main, Federal Republic of Germany
SO Journal of High Resolution Chromatography and Chromatography Communications, (1990), 13 (5) 382-385, 27 ref.
ISSN: 0344-7138
DT Journal
LA English
AB Use of heptakis (2,3,6-tri-O-methyl)-.beta.-**cyclodextrin** coated onto glass open-tubular columns, which are used in conjunction with GC-FID to allow stereodifferentiation of polar chiral **flavour** compounds found in fruits, Swiss cheese, etc., is described. Compounds analysed included underivatized 2-alkylated carboxylic acids and corresponding .alpha.-alkyl-substituted alkanols, ethyl 2-methylbutanoate, 1,2(1,3)-ketoalcohols and 3-hydroxy carboxylic acids. Chromatograms are reproduced and discussed, as is the unusual chromatographic behaviour of the series of homologues 1-alken-3-ols and their acetates.
CC A (Food Sciences)
CT ANALYTICAL TECHNIQUES; **FLAVOUR COMPOUNDS**; FOODS; GAS LIQUID CHROMATOGRAPHY
- L7 ANSWER 15 OF 51 FSTA COPYRIGHT 2003 IFIS
AN 1990(10):T0006 FSTA
TI **Flavor encapsulation**.
AU Reineccius, G. A.
CS Dep. of Food Sci. & Nutr., Univ. of Minnesota, St. Paul, MN 55108, USA
SO Food Reviews International, (1989), 5 (2) 147-176, 74 ref.
ISSN: 8755-9129
DT General Review
LA English
AB This review discusses some techniques used in **flavour encapsulation**, i.e. spray drying and extrusion (the 2 major processes), molecular inclusion via **cyclodextrins**, coacervation, fat **encapsulation** and miscellaneous processes (which usually involve some unique way of drying **flavour** emulsions). Each of these methods offers advantages and disadvantages for **encapsulation**, e.g. spray drying (most commonly used) is quite economical, allows substantial variation in **encapsulation** matrix and is readily available as regards processing capacity, but produces a product which is difficult to disperse and not particularly well protected against oxidation.
CC T (Additives, Spices and Condiments)
CT ADDITIVES; **ENCAPSULATION**; **FLAVOURINGS**; REVIEWS
- L7 ANSWER 16 OF 51 FSTA COPYRIGHT 2003 IFIS
AN 1989(03):A0080 FSTA
TI Aroma compounds retention during extrusion-cooking. In 'Frontiers of **flavor**', edited by Charalambous, G. Conference. Chalkidiki, Greece. 1-3 July 1987. 1000 AE Amsterdam, Netherlands; Elsevier Science Publishers BV. ISBN 0-444-42940-9 [see FSTA (1989) 21 3A1].
AU Sadafian, A.; Crouzet, J.; United States of America, American Chemical Society [1987 Flavour Symposium]

CS Cent. de Genie et Tech. Alimentaires, Univ. des Sci. et Tech. du
Languedoc, 34060 Montpellier Cedex, France
SO Developments in Food Science, (1988), 17, 623-637, 36 ref.
DT Conference
LA English
AB Retention of aroma compounds (limonene, p-cymene, linalool, geraniol,
terpenyl acetate and .beta.-ionone) during extrusion cooking of various
formulations (starch, starch-caseinate and a biscuit mix containing wheat
flour, starch, soy protein, caseinate, sucrose and salt) was studied.
Aroma compounds were added as emulsions in water, oil solutions,
microcapsules or .beta.-**cyclodextrin** inclusion complexes. Losses
of free volatiles (>90%) were controlled by water stripping during the
product expansion phase. Thermally-induced degradations and interactions
between aroma compounds and the matrix were also involved. Retention was
improved (to .ltoreq.30%) by natural or artificial **encapsulation**
and use of inclusion compounds. Use of multiple-walled microcapsules
achieved a retention of >90% for .beta.-ionone. [From En summ.]
CC A (Food Sciences)
CT AROMA COMPOUNDS; COOKING; EXTRUSION; EXTRUSION COOKING; FOODS; RETENTION

L7 ANSWER 17 OF 51 FSTA COPYRIGHT 2003 IFIS
AN 1988(10):T0028 FSTA
TI **Encapsulation of artificial flavors by .beta.-cyclodextrin.**
AU Reineccius, G. A.; Risch, S. J.
CS Dep. of Food Sci. & Nutr., Univ. of Minnesota, St. Paul, MN, USA
SO Perfumer & Flavorist, (1986), 11 (4) 1, 3-6, 17 ref.
ISSN: 0272-2666
DT Journal
LA English
AB Use of .beta.-**cyclodextrin** (a cyclic glucose polymer)
encapsulation of flavour compounds used for artificial
fruit **flavours** was investigated. A model **flavour**
system consisting of 14 components was prepared for .beta.-
cyclodextrin encapsulation and as a GLC calibration
standard. A **cyclodextrin-flavour** complex was prepared;
2 samples were analysed wet for volatiles profile, and 2 further samples
were dried to produce free-flowing powders. **Flavour** isolation
was accomplished by simultaneous steam distillation/solvent extraction
(diethyl ether) followed by GLC. Tabulated data for recovery of individual
compounds during **encapsulation**, i.e. total volatiles in filtrate
and wet (F & W) precipitate, and in filtrate and dry (F & D) powder showed
14-100% inclusion of the test compounds in .beta.-**cyclodextrin**,
the proportion increasing with mol. wt. The small losses observed during
drying suggested that variations are due mainly to specificity at the time
of complex formation. Although spray-drying yielded better overall and
more balanced **flavour** retention, specific retention of larger
molecules suggests **encapsulation** as an ideal method for
essential oils (even though iso-eugenol was not retained).
CC T (Additives, Spices and Condiments)
CT DEXTRINS; **ENCAPSULATION; FLAVOURINGS; Nb**
-CYCLODEXTRIN # SYNTHETIC; FRUIT FLAVOURINGS

L7 ANSWER 18 OF 51 FSTA COPYRIGHT 2003 IFIS
AN 1986(12):H0180 FSTA
TI Molecular **encapsulation** of natural and synthetic coffee
flavor with .beta.-**cyclodextrin**.
AU Szente, L.; Szejtli, J.
CS Biochem. Res. Lab. of Chinoin Pharmaceutical & Chemical Works Ltd.,
Budapest, Hungary
SO Journal of Food Science, (1986), 51 (4) 1024-1027, 18 ref.
DT Journal

LA English
AB Natural and synthetic coffee **flavours** were stabilized with .beta.-**cyclodextrin**. Upon contact with water, the complex bound **flavour** substances were released immediately. The transformation of greasy, oily or liquid coffee aroma concentrates into a microcrystalline stable inclusion complex may have practical importance, as regards use of this complex as an additive to enhance the sensory properties and quality of instant coffee products.

CC H (Alcoholic and Non-Alcoholic Beverages)
CT COFFEE; DEXTRINS; **ENCAPSULATION**; INSTANT FOODS; STABILITY; STABILIZERS; **Nb -CYCLODEXTRIN # INSTANT**; INSTANT COFFEE; MICROENCAPSULATION; STABILIZATION

L7 ANSWER 19 OF 51 FSTA COPYRIGHT 2003 IFIS
AN 1982(11):M1384 FSTA
TI [Effects on food **flavours** during baking of biscuits.]
AU Kobayashi, S.
CS Ogawa Koryo KK, Japan
SO New Food Industry [Nyu Fudo Indasutori], (1981), 23 (5) 16-19
DT Journal
LA Japanese
AB The author and his colleagues have used UV absorption to estimate the effect of baking for 9 min at 170.degree. C on various organic compounds added to biscuit mix, as models for food **flavours**. The amount of the added compound which remained after baking ranged from 0.1% for styrene (b.p. 145.degree. C) to 72% for benzylbenzoate (b.p. 325.degree. C). Of added acetophenone (b.p. 202.degree. C) 9.1% remained after baking. This was slightly improved by mixing at 1:9 with glyceryl fatty acid ester or salad oil before adding to the biscuit mix (to 10.1 and 11.7% resp.) but not by mixing with dextrin. Protecting acetophenone with **cyclodextrin**, without or with a fat **coating**, increased the amount remaining after baking to 33.0 and 45.0% resp. This was considerably better than the 6-7% that remained when conventional agents (gelatin, dextrin or gum arabic) were used.

CC M (Cereals and Bakery Products)
CT BAKING; BISCUITS; **FLAVOUR**

L7 ANSWER 20 OF 51 FSTA COPYRIGHT 2003 IFIS
AN 1980(04):T0234 FSTA
TI Molecular **encapsulation** of volatile, easily oxidizable labile **flavour** substances by **cyclodextrins**.
AU Szejtli, J.; Szenté, L.; Banky-Elöd, E.
CS Chinoin Pharmaceutical & Chem. Works, Biochem. Res. Lab., Budapest, Hungary
SO Acta Chimica Academiae Scientiarum Hungaricae, (1979), 101 (1/2) 27-46, 11 ref.
DT Journal
LA English
AB .beta.-**Cyclodextrin** inclusion complexes of 25 various **flavour** substances (spice aromatics and essential oils of vegetable origin, e.g. oils of onion, dill, lemon, garlic, marjoram, peppermint, tarragon) were prepared. The crystalline complexes contained 8-13% included substance, as determined by GLC. All major components of the original substances were present in the complexes, with practically unchanged composition. The fact of complex formation was proved by X-ray diffraction and stability tests. The O.sub.2 uptake of the **flavour** substances, measured by Warburg's method, was reduced to about one tenth by complexation. Volatile components are released from the complexes only above 160.degree. C, thus under normal storage conditions the volatility, oxidation and heat-decomposition are reduced to such an extent that the product can be stored for a long time without lessening its utility. These complexes can be used in the food industry as microbiologically

noncontaminated, stable aromatic preparations of standardized composition.

CC T (Additives, Spices and Condiments)

CT AROMA COMPOUNDS; DEXTRINS; **ENCAPSULATION**; ESSENTIAL OILS; LEMONS; ONIONS; SPICES; **CYCLODEXTRINS**; LEMON; LEMON ESSENTIAL OILS; ONION; SPICE; SPICE AROMA COMPOUNDS

L7 ANSWER 21 OF 51 FROSTI COPYRIGHT 2003 LFRA

AN 592279 FROSTI

TI **Flavor encapsulation** technologies: an overview including recent developments.

AU Uhlemann J.; Schleifenbaum B.; Bertram H.-J.

SO Perfumer and Flavorist, 2002, (September-October), 27 (5), 52-61 (28 ref.)

Published by: Allured Publishing Corporation. Address: 362 South Schmale Road, Carol Stream, IL 60188, USA. Telephone: +1 (630) 653 2155. Fax: +1 (630) 653 2192. Email: perfumer@allured.com Web: www.perfumerflavorist.com

ISSN: 0272-2666

DT Journal

LA English

SL English

AB The aim of this article is to provide **flavour** practitioners with an understanding of economically feasible and commercially available **encapsulation** technologies, as well as issues involved in these technologies and related products. Aspects discussed include definitions, considerations when selecting an **encapsulation** technology for a specific application, **flavour** spray-drying, compacting and agglomeration, fluidized spray drying, fluidized bed methods (spray granulation and **coating**), extrusion, coacervation and submerged nozzle process, spray chilling, and molecular inclusion (beta-**cyclodextrin**). A summary of the technologies is presented in a table, and a diagram is used to illustrate typical morphologies.

SH ADDITIVES

CT BASIC GUIDE; **ENCAPSULATION**; **FLAVOURINGS**; FLUID BEDS; SPRAY DRYING; TECHNOLOGY

DED 8 Oct 2002

L7 ANSWER 22 OF 51 FROSTI COPYRIGHT 2003 LFRA

AN 587542 FROSTI

TI **Flavor** stabilization in foods.

IN McBride C.; Qi H.; Hedges A.

PA Cerestar Holding BV

SO PCT Patent Application

PI WO 2002049455 A1

AI 20011219

PRAI United States 20001221; 20010326

DT Patent

LA English

SL English

AB The use of **cyclodextrin** as an effective **flavour** stabilizer for frozen foods and microwaveable foods is disclosed. The invention claims to ensure the desired taste and quality of said food products since **cyclodextrin** encloses **flavours** better than gum arabic, starches and other **flavour encapsulating** agents do in terms of storage stability and fewer off-**flavours**. The invention also eliminates the need to overuse **flavourings** in processing frozen and microwaveable foods, thereby resulting in reduced costs. The invention can also be applied in protecting **flavourings** and fragrances in pharmaceutical applications involving freezing and/or microwaving.

CT ADDITIVES; CONVENIENCE FOODS; **CYCLODEXTRINS**; DEXTRINS;

**ENCAPSULATED ADDITIVES; ENCAPSULATED
FLAVOURIN S; ENCAPSULATED PRODUCTS; FLAVOUR
COMPOUNDS; FLAVOURING CAPSULES; FLAVOURINGS; FROZEN
FOODS; MICROWAVE FOODS; PATENT; PCT PATENT; PRESERVED FOODS; STABILIZERS**
DED 26 Jul 2002

L7 ANSWER 23 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 576101 FROSTI
TI **Flavouring** compositions.
IN Tandy J.; Kim H.; Damiano D.
PA Societe des Produits Nestle SA
SO PCT Patent Application
PI WO 2002001967 A2
AI 20010508
PRAI United States 20000630
DT Patent
LA English
SL English
AB An **encapsulated flavouring** composition is based on a reaction product of aldehyde, ammonia and sulfide entrapped in a **cyclodextrin**. It can be prepared easily without needing laborious separations of organic and aqueous phases, is easy to handle and rehydrate, or dry blend with other **flavour** components. The reaction product can be a long-chain thiophene, pyridine and/or long-chain trithiane or trithiolane, which impart a meaty, roasted fat character.
SH ADDITIVES
CT **CYCLODEXTRINS; ENCAPSULANTS; ENCAPSULATED ADDITIVES; ENCAPSULATED FLAVOURINGS; FLAVOURINGS; PATENT; PCT PATENT; SAVOURY FLAVOURINGS**
DED 1 Mar 2002

L7 ANSWER 24 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 565670 FROSTI
TI **Flavour encapsulation** and release characteristics of spray-dried powder by the blended encapsulant of **cyclodextrin** and gum arabic.
AU Shiga H.; Yoshii H.; Nishiyama T.; Furata T.; Forssele P.; Poutanen K.; Linko P.
SO Drying Technology, 2001, 19 (7), 1385-1395 (11 ref.)
Published by: Marcel Dekker Inc Address: PO Box 5005, 185 Cimarron Road, Monticello, NY 12701-5185, USA Fax: +1 (914) 796 1772 Web: www.dekker.com
ISSN: 0737-3937
DT Journal
LA English
SL English
AB **Cyclodextrins** (CDs) complex with volatiles or unstable materials and are used as a method of preserving **flavours**. This study examined the spray drying of **encapsulated flavours** using a blend of beta-CD and gum arabic, and maltodextrin. The results indicated that the release of the **flavours**, delta-limonene and ethyl n-hexanoate during drying was decreased in samples blending maltodextrin and beta-CD in the feed liquid.
SH ADDITIVES
CT **CYCLODEXTRINS; DEXTRINS; DRYING; ENCAPSULATION; FLAVOURINGS; GUM ARABIC; GUMS; HYDROCOLLOIDS; MALTODEXTRINS; RELEASE; SENSORY PROPERTIES; SPRAY DRYING**
DED 16 Oct 2001

L7 ANSWER 25 OF 51 FROSTI COPYRIGHT 2003 LFRA

AN 560065 FROSTI
 TI The influence of beta-**cyclodextrin** on goaty **flavour**:
 characterization of synthetic inclusion complexes with capric acid and
 caprylic acid.
 AU Meier M.M.; Drunkler D.A.; Luiz M.T.B.; Fett R.; Szpoganicz B.
 SO British Food Journal, 2001, 103 (4-5), 281-290 (23 ref.)
 ISSN: 0007-070X
 DT Journal
 LA English
 SL English
 AB Goats' milk is similar to cows' milk in composition, but has a
 distinctive odour and **flavour**, which is objectionable to some.
 The substances responsible for this **flavour** are associated with
 the lipid system. Beta-**cyclodextrin** (beta-CD) consists of a
 number glucopyranose residues, which give the molecule the ability to
encapsulate hydrophobic molecules. This study examined the
 influence of beta-CD on the removal of goaty **flavour** from
 goats' milk. The results indicated that 0.4% beta-CD improved the
flavour of goats' milk and reduced the goaty **flavour** as
 determined by sensory panel. This was achieved by interaction of the
 molecule with short chain fatty acids, and caprylic and capric acids.

SH DAIRY PRODUCTS
 CT BETA **CYCLODEXTRIN**; **CYCLODEXTRIN** COMPLEXES;
CYCLODEXTRINS; DAIRY PRODUCTS; EXTRACTION; **FLAVOUR**
 COMPOUNDS; GOAT MILK; HYDROPHOBIC INTERACTIONS; INTERACTIONS; LIPIDS;
 MILK; ODOUR COMPOUNDS; OFF **FLAVOURS**; REDUCTION; SENSORY
 PROPERTIES
 DED 7 Aug 2001

L7 ANSWER 26 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 552167 FROSTI
 TI Microencapsulation of food **flavorings** in **cyclodextrin**
 and by spray drying and its release characteristics.
 AU Furuta T.; Yoshii H.; Shiga H.
 SO Foods and Food Ingredients Journal of Japan, 2001, (191), 23-31 (30 ref.)
 Published by: Foods and Food Ingredients Journal of Japan Address:
 1-1-11 Sanwa-cho, Toyonaka, Osaka 561-8588, Japan Telephone: +81 (6)
 6333 0521 Fax: +81 (6) 6333 8907 Email: ffij@ab.inbox.ne.jp Web:
 www.ffcr.or.jp/zaidan/ffcrhome.nsf/pages/ffij-jindex
 ISSN: 0919-9772
 DT Journal
 LA Japanese
 SL English; Japanese
 AB The development of **encapsulation** systems for the controlled
 release of **flavour** compounds is overviewed. Microencapsulation
 in **cyclodextrin** and by spray drying are described. The minimum
 number of water molecules required for inclusion into
cyclodextrin complexes was determined using an autocatalytic
 inclusion model. The addition of linear alcohols enhanced the formation
 of the inclusion complex. The retention of emulsified **flavour**
 during spray drying was investigated using various liquid feed
 compositions. The rate of release of **encapsulated** ethyl
 butyrate during storage depended both on the relative humidity of storage
 and on the type of emulsifier. The addition of 1% gelatin in the feed
 liquid significantly increased the retention of ethyl butyrate during
 spray drying and the control of the release rate.

SH ADDITIVES
 CT CONTROLLED RELEASE **FLAVOURINGS**; **CYCLODEXTRINS**;
 DRYING; **ENCAPSULATED FLAVOURINGS**;
ENCAPSULATION; FACTORS AFFECTING; **FLAVOUR** COMPOUNDS;
FLAVOURINGS; MICROENCAPSULATION; SPRAY DRYING
 DED 18 May 2001

L7 ANSWER 27 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 516574 FROSTI
 TI **Flavour** matrix interactions.
 AU Taylor A.J.
 SO Current topics in flavours and fragrances: towards a new millennium of discovery., Published by: Kluwer Academic Publishers, Dordrecht, 1999, 123-138 (69 ref.)
 Swift K.A.D.
 ISBN: 0-7514-0490-X
 DT Book Article
 LA English
 AB Food is a complex mixture of components that interact with **flavour** compounds to affect sensory properties during consumption. Because of the complexity of interactions, it can be very difficult to investigate **flavour**-matrix interactions. An overview of interactions between volatile **flavours** and various food matrices, and procedures used to study these interactions is provided. Consideration is given to interactions between volatile **flavours** and aqueous solutions at equilibrium and under non-equilibrium conditions; interactions between volatiles and starch (including starches with low-moisture contents and other biopolymers); interactions between volatiles and proteins; and the **encapsulation of flavours with cyclodextrins** and glassy matrices.
 SH ADDITIVES
 CT AQUEOUS SOLUTIONS; CARBOHYDRATES; **ENCAPSULATION**; **FLAVOUR** COMPOUNDS; INTERACTIONS; POLYSACCHARIDES; PROTEINS; SOLUTIONS; STARCH; VOLATILE COMPOUNDS
 DED 16 Mar 2000

L7 ANSWER 28 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 508653 FROSTI
 TI **Encapsulated flavours** and colours.
 AU Anon.
 SO Alimentos Procesados, 1999, (September), 18 (9), 34-38 (4pp) (0 ref.)
 ISSN: 0744-625X
 DT Journal
 LA Spanish
 AB Microencapsulation of **flavour** oils with **cyclodextrins** can considerably reduce or even eliminate their volatility and tendency to oxidation. It also improves their solubility in aqueous media. This article discusses the structure, properties, mechanisms and applications of **cyclodextrins**. Reference is also made to Firmenich's Durarome range of **flavourings**, which comprises **flavours** trapped inside an amorphous carbohydrate matrix; Chr. Hansen's Liquid Cap and Micro Cap **encapsulated** emulsifier-free natural colours; and a range of certified colours developed by BF Goodrich.
 SH ADDITIVES
 CT ADDITIVES; APPLICATIONS; BASIC GUIDE; BFGOODRICH; CHR HANSEN; COLOURS; **CYCLODEXTRINS**; DEXTRINS; **ENCAPSULATED FLAVOURINGS**; **ENCAPSULATION**; FIRMENICH; **FLAVOURINGS**; MICROENCAPSULATED **FLAVOURINGS**; MICROENCAPSULATION; MOLECULAR STRUCTURE; PROPERTIES; STRUCTURE
 DED 26 Nov 1999

L7 ANSWER 29 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 506540 FROSTI
 TI **Flavour encapsulation** applications.
 AU Sharma V.; Arora S.; Sindhu J.S.
 SO Indian Food Industry, 1999, (January-February), 18 (1), 39-48 (25 ref.)
 ISSN: 0253-5025

DT Journal
 LA English
 AB **Flavour encapsulation** technology is reviewed. **Flavour** is an important sensory property; **encapsulation** techniques were developed to prevent loss of **flavour**. The article discusses the need for this technology, defines the terms related to **encapsulation** (wall, capsule, dehydration media, core material, and process and suspending liquids), techniques for microencapsulation, molecular inclusion (using **cyclodextrins**), and applications of **encapsulation**. Spray-drying and coacervation are the processes by which microencapsulation is achieved, and the principal materials used are gum acacia, modified starch, maltodextrins, and hydrolysed starch. **Encapsulation** techniques have been applied to fats, vitamins, chewing gum, yoghurt, bakery and confectionery products, tofu, orange oil, coffee aroma, spices and oils, a new milk product that provides the richness of cream without the fat, and cheese **flavouring**.

SH ADDITIVES
 CT ADDITIVES; DIETARY SUPPLEMENTS; DIETETIC FOODS; **ENCAPSULATED FATS; ENCAPSULATED FLAVOURINGS; ENCAPSULATED PRODUCTS; ENCAPSULATED SPICES; ENCAPSULATED VITAMINS; ENCAPSULATING AGENTS; ENCAPSULATION; FAT PRODUCTS; FLAVOURINGS; MICROENCAPSULATION; SPICE PRODUCTS; VITAMIN SUPPLEMENTS; VITAMINS**

DED 29 Oct 1999

L7 ANSWER 30 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 504380 FROSTI
 TI Starch-based ingredients for **flavor encapsulation**.
 AU Qi Z.H.; Xu A.
 SO Cereal Foods World, 1999, (July), 44 (7), 460-465 (38 ref.)
 ISSN: 0146-6283

DT Journal
 LA English
 AB Methods for the **encapsulation** of **flavours** for use in foods are outlined, including spray drying, extrusion and co-precipitation. The characteristics and applications of starch-based food ingredients used for **flavour encapsulation** are described. Starch hydrolysis products consist of maltodextrins and corn syrup solids of various dextrose equivalents, which affect their carbohydrate distribution and physical properties. Emulsifying starches are starches modified with n-octenylsuccinic anhydride, and usually subsequently depolymerized by acid hydrolysis, pyrodextrinization, or enzyme hydrolysis. Beta-**cyclodextrin** is a promising new **flavour** carrier. Examples are given of the use of these materials for **encapsulating** spray-dried orange oil and their effects on oil recovery and oxidation stability. Applications in soft drinks, tea, chewing gum and other products are mentioned.

SH ADDITIVES
 CT APPLICATIONS; BETA **CYCLODEXTRIN**; CITRUS OILS; CITRUS PRODUCTS; CORN SYRUP SOLIDS; **CYCLODEXTRINS**; DEXTRINS; ENCAPSULANTS; **ENCAPSULATION**; ESSENCES; ESSENTIAL OILS; **FLAVOURINGS**; FRUIT PRODUCTS; INGREDIENTS; MALTODEXTRINS; MODIFIED STARCHES; ORANGE OIL; ORANGE PRODUCTS; PROPERTIES; STARCH HYDROLYSATES

DED 30 Sep 1999

L7 ANSWER 31 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 471814 FROSTI
 TI Stabilisation of **flavourants**.
 IN O'Reilly R.E.
 PA British-American Tobacco Co. Ltd
 SO European Patent Application

PI EP 840555 A1
 WO 9702759 19970130
 AI 19960705
 PRAI United Kingdom 19950707
 DT Patent
 LA English
 SL English
 AB Some **flavorants** are too volatile or odorous to be used directly in foodstuffs, and **encapsulation** methods have been developed to overcome this problem. Beta-**cyclodextrin** is frequently used as an encapsulant, but each beta-**cyclodextrin** molecule can **encapsulate** only a limited number of **flavour** molecules, generally only one per beta-**cyclodextrin** ring. This invention relates to an alternative method for **encapsulation**. The method involves contacting an aqueous ionic solution, preferably containing a source of potassium ions, with a mixture of carrageenan and **flavorant**. A high level of **flavorant** may be stabilized per unit amount of carrageenan. The **encapsulated flavours** are released only on exposure of the stabilized **flavorant** to elevated temperatures. The **encapsulated flavour** could be, e.g., onion oil in burgers, the **flavour** being released upon cooking the burgers.
 SH ADDITIVES
 CT CARRAGEENAN; **ENCAPSULATION**; EUROPEAN PATENT; **FLAVOUR**; GELS; HIGH; HIGH TEMPERATURE; RELEASE; TEMPERATURE
 DED 24 Jul 1998

L7 ANSWER 32 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 448203 FROSTI
 TI Infusion of hydrophobic **flavourings** in powders by spray-drying of emulsions and molecular **encapsulation**.
 AU Furuta T.; Hisamatsu F.
 SO Engineering and food at ICEF 7: proceedings of the 7th International Congress on Engineering and Food, Part 2., Published by: Sheffield Academic Press, Sheffield, 1997, G85-G88 (2 ref.)
 Jowitt R.
 ISBN: 1-85075-814-X
 DT Conference Article
 LA English
 SL English
 AB This paper discusses two methods for the **encapsulation** of hydrophobic **flavourings** into powders: air-drying of emulsified **flavourings**, and molecular **encapsulation** of the **flavourings** with **cyclodextrins**. Liquid and solid **flavourings** were studied; they included d-limonene, allyl isothiocyanate, l-menthol and beta-thujaplicin. The effect of air temperatures and emulsion saccharide content on the **flavour** retention on drying a single droplet of d-limonene emulsion was studied. The effect of humidity and temperature on the **flavour** release of **cyclodextrin-encapsulated flavourings** was also investigated.
 SH ADDITIVES
 CT **CYCLODEXTRINS**; **ENCAPSULATION**; **FLAVOUR** RETENTION; **FLAVOURINGS**; HYDROPHOBIC; PERFORMANCE
 DED 6 Nov 1997

L7 ANSWER 33 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 429549 FROSTI
 TI Microencapsulation of **flavour** compounds.
 AU Bhandari B.R.; D'Arcy B.R.
 SO Food Australia, 1996, 48 (12), 547-551 (many ref.)
 DT Journal

LA English
AB Microencapsulated **flavours** are generally more stable and easier to handle and mix than traditionally formulated **flavours**. This review paper traces the development of different microencapsulation techniques and discusses their usefulness for particular applications. It considers coacervation, spray drying, extrusion, the formation of inclusion complexes with beta-**cyclodextrin**, co-crystallisation, fat **encapsulation**, and adsorption of aromatic **flavour** components on a dry support to produce a free-flowing powder from a liquid **flavour**.

SH ADDITIVES
CT APPLICATIONS; **FLAVOURINGS**; MICROENCAPSULATED; PROPERTIES;
REVIEW
DED 7 Mar 1997

L7 ANSWER 34 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 426175 FROSTI
TI Stabilisation of **flavourants**.
IN O'Reilly R.E.
PA British-American Tobacco Co. Ltd
SO PCT Patent Application
PI WO 9702759 A1
AI 19960705

PRAI United Kingdom 19950707
DT Patent
LA English
SL English

AB Some **flavorants** are too volatile or odorous to be used directly in foodstuffs, and **encapsulation** methods have been developed to overcome this problem. Beta-**cyclodextrin** is frequently used as an encapsulant, but each beta-**cyclodextrin** molecule can only **encapsulate** a limited number of **flavour** molecules, generally only one per beta-**cyclodextrin** ring. This invention relates to an alternative method for **encapsulation**. The method involves contacting an aqueous ionic solution, preferably containing a source of potassium ions, with a mixture of carrageenan and **flavorant**. A high level of **flavorant** may be stabilised per unit amount of carrageenan. The **encapsulated flavours** are only released on exposure of the stabilised **flavorant** to elevated temperatures. The **encapsulated flavour** could be, e.g., onion oil in burgers, the **flavour** being released upon cooking the burgers.

SH ADDITIVES
CT CARRAGEENAN; **ENCAPSULATION**; **FLAVOUR**; GELS; HIGH; HIGH
TEMPERATURE; PCT PATENT; RELEASE; TEMPERATURE
DED 7 Mar 1997

L7 ANSWER 35 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 406521 FROSTI
TI **Flavour** technology: physical chemistry, modification, and process: proceedings of a symposium, Washington D.C., August 1994.
AU Ho C.T.; Tan C.T.; Tong C.H.; American Chemical Society
SO Published by: ACS, Washington D.C., 1995, 266pp.
ACS Symposium Series, 610
ISBN: 0-8412-3326-8

DT Conference
LA English

AB The topics covered in this book include the role of physical chemistry in the production of **flavours**; formation and degradation of morpholino-1-deoxy-D-fructose; formation of oxygen-containing heterocyclic compounds via the Maillard reaction; effect of water content and amino acids on Maillard browning; tetramethylpyrazine formation under

high hydrostatic pressure; modelling Maillard browning; scale-up of automated thermally reacted **flavour** processes; production of natural **flavours** using cold extrusion; a novel membrane process for folding essential oils; oxidative stability of **encapsulated** seal blubber oil; location of vanillin in a food emulsion system; predicting the stability of **flavour**; rheological properties and stability of foams and emulsions; speciality food starches in **flavour** emulsions; phospholipid and non-phospholipid liposomes for **flavour encapsulation**; functions of **cyclodextrins**; and the role of speciality food starches in **flavour encapsulation**.

CT ACCELERATION; BROWNING; BROWNING REACTION PRODUCTS; COMPOUNDS; **CYCLODEXTRINS**; DETERMINATION; EMULSIONS; **ENCAPSULATION**; **FLAVOUR**; **FLAVOUR** COMPOUNDS; **FLAVOURINGS**; FORMATION; INCREASE; MAILLARD REACTION; MATHEMATICAL; MATHEMATICAL MODELS; MODELS; PRODUCTION; PROPERTIES; RATE; REACTION PRODUCTS; RHEOLOGICAL; RHEOLOGICAL PROPERTIES; STABILITY; STARCH; STARCH REACTION PRODUCTS

DED 18 Apr 1996

L7 ANSWER 36 OF 51 FROSTI COPYRIGHT 2003 LFRA

AN 406519 FROSTI

TI Use of **cyclodextrins** for **flavors**.

AU Qi Z.H.; Hedges A.R.

SO Flavor technology: physical chemistry, modification, and process: proceedings of a symposium, Washington D.C., August 1994., Published by: ACS, Washington D.C., 1995, 231-243 (30 ref.)
Ho C.T.

ISBN: 0-8412-3326-8

DT Conference Article

LA English

AB This paper describes the molecular structure, chemical and physical properties, metabolism and toxicology of **cyclodextrins**; the production of **cyclodextrin** derivatives; inclusion complexation by **cyclodextrins**; preparation of **cyclodextrin-flavour** complexes; release of complexed **flavours**; application of **cyclodextrins** as food additives (stabilisation, solubilisation and taste modification); complexation with liquid **flavourings**; and the use of **cyclodextrins** as process aids.

SH ADDITIVES

CT APPLICATIONS; CHEMICAL; CHEMICAL PROPERTIES; COMPLEXES; COMPOUNDS; **CYCLODEXTRINS**; **ENCAPSULATION**; **FLAVOUR**; **FLAVOUR** COMPOUNDS; INCREASE; METABOLISM; PHYSICAL; PHYSICAL PROPERTIES; PROPERTIES; SOLUBILITY; STABILITY; STRUCTURE; TOXICITY

DED 18 Apr 1996

L7 ANSWER 37 OF 51 FROSTI COPYRIGHT 2003 LFRA

AN 378607 FROSTI

TI Microencapsulated **flavors**: manufacture and possible applications.

AU Eckert M.

SO Dragoco Report Flavoring Information Service, 1995, (1), 5-19 (6 ref.)

DT Journal

LA English

SL English

AB A description of available microencapsulation processes and their applications is given. Six processes are described. Spray drying is most widely used because it is economical, flexible and suitable for many food applications. Vacuum drying is used mainly for natural products e.g. amaretto **flavour** in coffee. Extrusion (using 'amorphous' sugars as the carrier) is carried out at lower temperature, so is useful

for delicate ingredients and vitamin C. However, it is expensive. Coacervation is used for **encapsulation** of expensive active ingredients, but is not widely used in the food industry. Molecular **encapsulation** in B-**cyclodextrin** often distorts the **flavour** profile and **flavour** release is poor except in water surplus or at high temperature. **Coating** processes are used to protect delicate additives such as vitamins. Sugar, modified starches, vegetable gums and high-melting-point fats are used for **coating**. Two main processes are used for **coating**: fluidised-bed **coating** and centrifugal **coating**.

SH ADDITIVES
CT **FLAVOURING; MICROENCAPSULATION; PROCESSING**
DED 19 Jul 1995

L7 ANSWER 38 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 359559 FROSTI

TI The **flavours** report.

AU Bullen J.D.

SO Food Tech Europe, 1994, 1 (2), 20-30 (6pp.) (19 ref.)

DT Journal

LA English

SL English

AB The increase in consumption of processed foods has resulted in a growth in the market for food additives and in particular for **flavouring** agents. The **flavour** industry is also expanding into the new markets of Eastern Europe. Changes in food legislation in the UK and the EC are seen as providing new opportunities and challenges for **flavourings** manufacturers. The importance of research and development as a means of keeping pace with change is discussed. Biotechnology, genetic engineering, the introduction of multifunctional ingredients and new methods of release are key areas in **flavour** development. Improvements in extraction techniques with the introduction of the spinning-cone column, carbon dioxide extraction and membrane technology, as well as developments in **encapsulation** and new **flavour** carriers, such as beta-**cyclodextrin**, are described. Future areas of interest in the **flavour** industry are seen to be Kosher foods, and quality management.

CT EXTRACTION; **FLAVOURINGS**; LEGISLATION; MARKETING; PRODUCTION
DED 9 Dec 1994

L7 ANSWER 39 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 333652 FROSTI

TI **Flavour** manufacturing: Part II. **Flavor encapsulation**.

AU Reineccius G.A.

SO Source book of flavors. (2nd ed.), Published by: Chapman and Hall, London, 1994, 605-625 (58 ref.)

Reineccius G.A.

ISBN: 0-442-00376-5

NTE REFERENCE ONLY

DT Book Article

LA English

AB The article describes techniques used in the **encapsulation** of **flavouring** materials in order to produce free-flowing powders for use in dry products. Reference is made to the use of spray drying, extrusion, molecular inclusion via **cyclodextrins**, coacervation, and fat-**encapsulation** processes.

SH PROCESSING

CT COMPOUNDS; **CYCLODEXTRINS**; DRYING; **ENCAPSULATION**;
EXTRUSION; FAT POWDERS; FATS; **FLAVOUR**; **FLAVOUR**
COMPOUNDS; **FLAVOURINGS**; POWDERS; PROCESSING; PRODUCTION; SPRAY
DRYING

DED 21 Jan 1994

L7 ANSWER 40 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 324455 FROSTI
TI Applications of **cyclodextrins** (Kleptose) in food
flavouring.
AU Serpelloni M.; Bue R.
SO Food ingredients Asia: conference proceedings, Singapore, April 1991.,
Published by: Expoconsult Publishers, Maarssen, 1991, 48-50 (2 ref.)
Food Ingredients Asia; Expoconsult Publishers.
ISBN: 90-73220-07-6
DT Conference Article
LA English
AB This paper examines the use of B-**cyclodextrin** (BCD) as a
flavour carrier, with reference to reaction mechanisms associated
with the production of BCD inclusion compounds; industrial preparation
methods used for the production of BCD inclusion compounds; compared
efficiency of the industrial preparation methods applied to the
production of a natural mint oil inclusion compound; and the advantages
of BCD compared with other types of carriers.
SH ADDITIVES
CT APPLICATIONS; CARRIERS; COMPOUNDS; **CYCLODEXTRINS**;
ENCAPSULATION; **FLAVOUR**; **FLAVOUR** COMPOUNDS;
KLEPTOSE; MECHANISMS; PRODUCTION; PROTECTION; STABILIZATION
DED 20 Sep 1993

L7 ANSWER 41 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 266318 FROSTI
TI **Flavor encapsulation**.
AU Reineccius G.A.
SO Food Reviews International, 1989, 5 (2), 147-76 (74 ref.)
DT Journal
LA English
SL English
AB Methods of commercial significance for the **encapsulation** of
food **flavourings** are reviewed. The two major processes, spray
drying and extrusion, are described. Other techniques that show
commercial potential - molecular inclusion via **cyclodextrins**,
coacervation and fat **encapsulation** - are discussed.
CT COACERVATING; **CYCLODEXTRINS**; DRYING; **ENCAPSULATION**;
EXTRUSION; FATS; **FLAVOURINGS**; LIPIDS; POLYSACCHARIDES; REVIEW;
SPRAY DRYING
DED 25 Sep 1991

L7 ANSWER 42 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 263897 FROSTI
TI Stereoisomeric **flavour** compounds. 48. Chirospecific analysis of
natural **flavours** and essential oils using multidimensional gas
chromatography.
AU Mosandl A.; Fischer K.; Hener U.; Kreis P.; Rettinger K.; Schubert V.;
Schmarr H.-G.
SO Journal of Agricultural and Food Chemistry, 1991, 39 (6), 1131-4 (28
ref.)
DT Journal
LA English
SL English
AB Multidimensional gas chromatography, employing heart-cutting techniques
from a polar, non-chiral pre-separation column onto a chiral main column,
coated with a modified beta-**cyclodextrin**, was used to
study the enantiomeric distribution of 2-methyl butanoic acid in apples
and of chiral alcohols from bananas. The differentiation of the chiral
monoterpenes alpha-pinene, beta-pinene and limonene from essential oils

and the evaluation of chiral 1,2-ketols from honey are also reported. The specific distribution of enantiomers is discussed as an indicator of the authenticity of natural **flavours** and essential oils.

CT COMPOUNDS; DETERMINATION; ENANTIOMERS; **FLAVOUR**; **FLAVOUR**
COMPOUNDS
DED 4 Sep 1991

L7 ANSWER 43 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 246056 FROSTI

TI **Flavor encapsulation** update.

AU Reineccius G.A.

SO Cereal Foods World, 1990, 35 (10), 1043-4

DT Journal

LA English

AB Some advances in **encapsulation** of **flavouring** agents are outlined, including development of replacements for traditional gum acacia, inclusion via beta-**cyclodextrin**, spray atomisation, spraying a **flavour** emulsion into ethanol, and sucrose cocrystallisation. Possibilities for future studies are mentioned.

CT ATOMISATION; BETA **CYCLODEXTRINS**; COCRYSTALLISING;
CYCLODEXTRINS; **ENCAPSULATION**; ETHANOL;
FLAVOURINGS; GUM ARABIC; GUMS; MODIFIED STARCHES; SPRAYING;
STARCH; SUCROSE

DED 22 Jan 1991

L7 ANSWER 44 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 198140 FROSTI

TI The role of carbohydrates in **flavor** development.

AU Godshall M.A.

SO Food Technology, 1988, 42 (11), 71-8 (5pp.) (55 ref.)

DT Journal

LA English

AB The effects of carbohydrates, especially sugars and hydrocolloids, on the **flavour** of food systems are discussed. Carbohydrates usually have a sweet, bittersweet or bitter taste if they have any taste at all. Carbohydrates may also have the following effects on sweetness: synergy, taste and **flavour** suppression, aroma changes, complex formation with metals and **flavour** carrying and **encapsulation**.

CT ADSORPTION; APPLICATIONS; BITTERNESS; BROWING; BROWNING; CARBOHYDRATES;
CARRIERS; COMPLEXATION; COMPLEXES; COMPOUNDS; **CYCLODEXTRINS**;
DISACCHARIDES; **ENCAPSULATION**; ENZYMES; FACTORS AFFECTING;
FLAVOUR; **FLAVOUR** COMPOUNDS; **FLAVOURINGS**;
FORMATION; FRUCTOSE; GLUCOSE; GUMS; HYDROCOLLOIDS; INTENSITY; IRON
COMPLEXES; METAL COMPLEXES; MONOSACCHARIDES; POLYSACCHARIDES; REDUCTION;
STARCH; SUGAR; SWEETENERS; SWEETNESS; SYNERGISM; VOLATILE COMPOUNDS

DED 17 Apr 1989

L7 ANSWER 45 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 196255 FROSTI

TI Stabilization of **flavors** by **cyclodextrins**.

AU Szenté L.; Szejtli J.

SO Flavor encapsulation, edited by S.J. Risch and G.A. Reineccius.

Washington D.C.: ACS, 148-57 (7 ref. En)., 1988

LFRA Book Database Number:, 0007932

ISBN: 0-8412-1482-4

NTE Based on a paper presented at a symposium sponsored by the Division of Agricultural and Food Chemistry at the 194th Meeting of the American Chemical Society, New Orleans, USA, 1987.

DT Conference Article

CT APPLICATIONS; CAPSULES; COMPLEXES; **CYCLODEXTRINS**; DEGRADATION;
ENCAPSULATING AGENTS; **ENCAPSULATION**; **FLAVOUR**;
FLAVOURINGS; GRAPEFRUITS; HEATING; INCREASE; INHIBITION; JASMINE;

LEMON OIL; LIGHTING; OILS; OXIDATION; PEPPERMINT; POLYSACCHARIDE
COMPLEXES; POLYSACCHARIDES; PREVENTION; PROPERTIES; REDUCTION; RETENTION;
STABILITY; STABILIZATION; TYPE

DED 12 Apr 1989

L7 ANSWER 46 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 190947 FROSTI
TI Tea aromatization with beta-**cyclodextrin** complexed
flavours.

AU Szente L.; Gal-Fuzy M.; Szejti J.
SO Acta Alimentaria, 1988, 17 (2), 193-9 (6 ref.)
DT Journal
LA English
SL English

AB The majority of **flavours** employed to add extra aroma to tea are
volatile and sensitive to oxidation and light. Beta-**cyclodextrin**
complexed bergamot, jasmine, peppermint and cinnamon oils were added to
Ceylon black tea and stability and sensory tests performed. The use of
beta-**cyclodextrin** entrapped **flavouring** materials
resulted in improved stability, storability and sensory value of tea
products.

CT BETA **CYCLODEXTRINS**; COMPLEXES; **CYCLODEXTRINS**;
ENCAPSULATED; **ENCAPSULATED FLAVOURINGS**;
ESSENTIAL OILS; **FLAVOURING**; **FLAVOURINGS**; OILS;
STABILITY; STABILIZATION; TEA

DED 18 Oct 1988

L7 ANSWER 47 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 188679 FROSTI
TI Engineering **flavour** systems.

AU Best D.
SO Prepared Foods, 1987, 156 (12), 116-26 (7pp.)
DT Journal
LA English

CT ACIDS; AGE; APPLICATIONS; ASPARTAME; BACTERIA; BASES; CEREAL PRODUCTS;
CHEDDAR CHEESE; CHEESE; CITRIC ACID; COMPOSITION; COMPOUNDS; COOKING;
CYCLODEXTRINS; D GLUCOSE; DESIGN; DETERIORATION; DEVELOPMENT;
ENCAPSULATION; ENGINEERING; EVALUATION; EXTRUDED CEREAL PRODUCTS;
EXTRUDED FOODS; EXTRUDED SNACKS; EXTRUSION; FACTORS AFFECTING;
FLAVOUR; **FLAVOUR** PROFILES; **FLAVOUR** PROFILING;
FLAVOURINGS; FRUCTOSE; FRUITS; GLUCOSE; IMPROVEMENT; INCREASE;
INTERACTIONS; LIPOSOMES; LONG LIFE; MALIC ACID; MICROBIAL
FLAVOURINGS; MICROORGANISMS; MICROWAVE COOKING; MICROWAVE FOODS;
MICROWAVEABLE **FLAVOURINGS**; MICROWAVES; MICROWAVING; OFF
FLAVOURS; PACKAGING; PERCEPTIONS; PREVENTION; PROCESSING;
PRODUCTION; PROFILES; PROPERTIES; PSEUDOMONAS; REDUCTION; RESEARCH;
SALTINESS; SENSORY ANALYSIS; SHELF LIFE; SNACK FOODS; SPOILAGE; SUCROSE;
SWEETENERS; SYNERGISM; TARTARIC ACID; YEAST **FLAVOURING**; YEASTS

DED 24 Aug 1988

L7 ANSWER 48 OF 51 FROSTI COPYRIGHT 2003 LFRA
AN 165806 FROSTI
TI **Encapsulation** of artificial **flavors** by beta-
cyclodextrin.

AU Reineccius G.A.; Risch S.J.
SO Perfumer and Flavorist, 1986, 11 (4), 1-6 (5pp.) (17 ref.)
DT Journal
LA English

CT BETA **CYCLODEXTRINS**; **CYCLODEXTRINS**; DRYING;
ENCAPSULATION; ESSENTIAL OILS; **FLAVOURINGS**; OILS;
PROPERTIES; QUALITY

DED 21 Nov 1986

L7 ANSWER 49 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 165108 FROSTI
 TI Molecular **encapsulation** of natural and synthetic coffee **flavor** with beta-**cyclodextrin**.
 AU Szente L.; Szejtli J.
 SO Journal of Food Science, 1986, 51 (4), 1024-7 (18 ref.)
 DT Journal
 LA English
 SL English
 AB The interaction between volatile coffee **flavour** constituents and beta-**cyclodextrin** was investigated. Natural and synthetic coffee **flavours** could be stabilised with beta-**cyclodextrin**. Upon contact with water the complex brand **flavour** substances were released immediately. The use of a stable microcrystalline inclusion complex may have applications as an additive to enhance the sensory properties and quality of instant coffee.
 CT BETA **CYCLODEXTRINS**; BEVERAGES; COFFEE; COFFEE **FLAVOURING**; COMPLEXES; COMPOSITION; **CYCLODEXTRINS**; **ENCAPSULATION**; **FLAVOUR**; **FLAVOUR** COMPOUNDS; **FLAVOURINGS**; IMPROVEMENT; INSTANT BEVERAGES; INSTANT COFFEE; NATURAL **FLAVOURINGS**; PROPERTIES; SENSORY PROPERTIES; STABILIZATION; SYNTHETIC **FLAVOURINGS**; VOLATILE COMPOUNDS
 DED 7 Nov 1986

L7 ANSWER 50 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 140902 FROSTI
 TI **Flavour** containing edible oil.
 IN Konishi T.; Komiya J.; Yoneda T.
 PA Takasago Perfumery Company Limited.
 SO Japanese Patent Application
 PI JP 53018775
 DT Patent
 LA English
 CT BISCUITS; BUTTER **FLAVOURING**; **CYCLODEXTRINS**; **ENCAPSULATED FLAVOURINGS**; **ENCAPSULATION**; **FLAVOURINGS**; OILS
 DED 1 Oct 1980

L7 ANSWER 51 OF 51 FROSTI COPYRIGHT 2003 LFRA
 AN 90650 FROSTI
 TI Stabilization of **flavors** by **cyclodextrins**.
 AU Szente L.; Szejtli J.
 SO Flavor encapsulation, edited by S.J. Risch and G.A. Reineccius. Washington D.C.: ACS, 148-57 (7 ref. En)., 1988
 LFRA Book Database Number:, 0007932
 ISBN: 0-8412-1482-4
 NTE Based on a paper presented at a symposium sponsored by the Division of Agricultural and Food Chemistry at the 194th Meeting of the American Chemical Society, New Orleans, USA, 1987.
 DT Conference Article
 CT APPLICATIONS; CAPSULES; COMPLEXES; **CYCLODEXTRINS**; DEGRADATION; **ENCAPSULATING AGENTS**; **ENCAPSULATION**; **FLAVOUR**; **FLAVOURINGS**; GRAPEFRUITS; HEATING; INCREASE; INHIBITION; JASMINE; LEMON OIL; LIGHTING; OILS; OXIDATION; PEPPERMINT; POLYSACCHARIDE COMPLEXES; POLYSACCHARIDES; PREVENTION; PROPERTIES; REDUCTION; RETENTION; STABILITY; STABILIZATION; TYPE
 DED 12 Apr 1989